THE AUDIPHONE AND DENTAPHONE

BY

CHAS. S. TURNBULL, M.D.

OF PHILADELPHIA

[REPRINTED FROM THE ARCHIVES OF OTOLOGY, VOLUME VIII, NO. 4.]

NEW YORK
G. P. PUTNAM'S SONS
182 FIFTH AVENUE
1879

THE AUDIPHONE AND DENTAPHONE.

By CHAS. S. TURNBULL, M. D., of Philadelphia.

FOR many years various inventors have been engaged in devising some means whereby the deaf could be relieved from their infirmity, be enabled to hear spoken words and carry on conversation with those around them. One device has succeeded another, each only leaving the sufferer more disappointed than the last, until finally he has given up all hopes of relief, or, as in certain cases, is compelled to fall back on the clumsy, old-fashioned ear-trumpet. In a large number of instances, however, even the ear-trumpet could not be used, as the defect in the hearing was of such a nature that the sound vibrations, however intensified by an ear-trumpet or other device, could not be transmitted through the external or middle ear to the auditory nerve. Under these circumstances no advance seemed possible in the way of enabling the deaf to hear, and those who best understood the difficulties to be overcome could give no hopes of success.

The wonderful accuracy with which the phonograph and the telephone registered and reproduced the human voice, taken in connection with the fact that the nerves of hearing could be reached directly through the teeth and the cranial bones, led to the conclusion that if some instrument could be devised, sensitive enough to gather up the delicate sound vibrations that make up articulate speech, and convey them to the teeth, the problem of enabling the deaf to hear would be solved.

The instruments under consideration are the results of a long series of experiments based upon similar scientific facts, with which is coupled another acoustic principle, viz.: the superior power possessed by solid bodies of conducting or transmitting sonorous vibrations. To demonstrate this we would call attention to the tuning-fork, acoumeter, or watch, when placed on the teeth or cranial bones.

The first instrument to which our attention was directed was called the "audiphone," by its inventor, R. S. Rhodes, of Chicago, who, while searching for some means by which he might improve his hearing,* accidentally placed his watch between his teeth, and heard it ticking. After numerous experiments, based upon this observation, the inventor was completely successful in his own case, and the instrument with which he readily hears all ordinary sounds and conversations is the one he now offers to the afflicted public.

FIG. 1.

The instrument (Fig. 1) consists essentially of a diaphragm of hard rubber. This diaphragm is very thin and elastic, and is cut in the form of a square with rounded corners, so as to present a collecting surface about one square foot in size. For purposes of convenient adjustment, it is furnished with a neat hard-rubber handle, and might easily, says the inventor, be taken for a fan of Japanese pattern. When in use the upper and lower edges are made to approximate by a silken cord, so as to present a convex surface to the speaker and a concave one to the listener. The cord may be fastened at any convenient convexity of the surface of the auditory disk. When adjusted, the upper edge is pressed firmly against the anterior surface of the upper incisors, allowing the upper lip to rest upon the diaphragm, and the deaf person is then ready to listen. If the eye-teeth can be used, they generally give the best results. False teeth may also be used, especially if they fit tightly; should they not, however, they may be made to do so by pressing the

* Mr. R. lost his hearing through changes due to a chronic aural and post-nasal catarrh.

lower teeth against them. If the natural teeth be too far gone to be used as directed, the roots may in many instances be utilized by having artificial teeth set into them. The handle of the audiphone should be held lightly, and the lower teeth should not touch the diaphragm, nor should it be held between the teeth or pressed too forcibly against the upper ones, thus curving the instrument already bent by the cord. It must be borne in mind that in all cases the vibrations of the upper edge of the disk impart to the upper teeth the sound-waves, which are transmitted through them to the cranial bones and auditory nerves.

The audiphone, therefore, is entirely dependent upon the condition of the auditory nerves, because in direct proportion to the inherent power of these nerves—independent of the external and middle ears or acoustic apparatus—is the influence which this and all similar appliances will exert over the hearing power.

Before, however, we can arrive at any satisfactory conclusions concerning the actual practical value of the audiphone, we must define the words "deaf" and "deaf-mute" as ordinarily accepted, because upon a proper appreciation of the meaning of these common and vague terms, hinge the merits of the instrument for which miracles are inadvertantly claimed by its inventor, and ignorantly ascribed to it by the public.

To the medical man the word "deaf" is generally understood to express diminution of hearing power to any degree, unless the term be qualified by some word expressing the amount of deafness, be it partial, profound or absolute.

To the layman, the word "deaf" implies absolute deafness, while to him degrees of diminution of hearing power are best understood as "hardness of hearing," etc.

Again, to the medical man, the word "deaf-mute" is equally unsatisfactory, although it is usually understood to express absolute deafness since birth, hence muteism, unless the term be likewise qualified by some such prefix, as partial, semi or absolute, is too vague an expression.

To the layman, the word "deaf-mute" is understood to mean precisely what, when taken separately, the two words imply.

In this particular connection we have assumed that "the deaf," as a class, should be divided into—

a. Those who are *absolutely* deaf from *nervous* or *inner ear* deafness.

b. Those who are *profoundly* deaf from *acoustic* or *middle ear* deafness.

And likewise the "deaf-mutes" as a class into—

c. Those who are *absolute deaf-mutes.*

d. Those who are *semi-deaf-mutes* (and semi-mutes).

Absolute nervous deafness (*a*), which is comparatively rare, is in no way whatever benefitted by the application of the audiphone.

This deafness is caused *by direct implication of the auditory nerve*, through malignant, scarlet and typhoid fevers, cerebro-spinal and other forms of meningitis, tertiary syphilis, cerebral tumors, trauma, consanguinity, hereditation, old age, etc.

Profound acoustic deafness (*c*), which is likewise comparatively rare, is markedly, and in some cases signally, relieved by the use of the audiphone.

This deafness is caused through *direct implication of the middle ear* (or conducting apparatus) and its appendages, through the several forms of catarrhal and purulent inflammations, scarlet and typhoid fevers, secondary syphilis, trauma, consanguinity, hereditation, old age, etc.

Those who are *partially* deaf, from whatever cause, as a rule derive no benefit from the application of the audiphone; on the contrary, many such cases are annoyed by hyperacusis, etc.

Therefore the number of cases in which "the deaf are made to hear" with the audiphone is comparatively small, when we take into consideration the whole number of our deaf population. Audition will be improved by its use in but few of the many deaf persons who enlist the services of an aurist.

To use the audiphone with success the auditory nerves must be normally sensitive, the hearing power for loud voice, through middle ear deafness, must be reduced to a minimum, and the upper front teeth must be solid. The

acoumeter, the tuning-fork, a thin sheet of vulcanite, of iron, of ash or poplar wood, and, best of all, a sheet of bristol-board or sized paper, will in every case enable us to decide whether the audiphone or its principle can be successfully applied.

Proficiency in its use requires practice, and those who for a long time have not heard ordinary conversation or their own voices, and who are accustomed, wholly or in part, to interpret sound by the movement of the lips of the person speaking, may not distinguish the words of the speaker when first using the audiphone, though the sound of these words be distinctly heard. The inventor being well aware, doubtless through experience, of the fact that when those with impared hearing know what to expect, they hear twice as well, offers the following as a method of practice that will enable many such to rely wholly upon sound: "Such persons should request a friend to read aloud, while they (the listeners) should carefully observe the words (as spoken) in a duplicate book or paper. When this is properly done, deaf persons will be surprised with what distinctness every word may be heard by the use of the audiphone, and they can in this way *educate* themselves."

Concerning *absolutely deaf-mutes* and the audiphone, we need say nothing further. They must be left to the patient teachers of the several methods of educating the true deaf-mutes.

To the *semi-deaf-mutes*, however, the audiphone will open a new world of enjoyment, and prove a useful instrument, especially in the hands of all instructors in our asylums for the deaf and dumb. In educating children according to Bell's method of visible speech, especially as very few even of those who are supposed to be born deaf are totally without some slight degree of hearing power, hence, nearly all of those educated in the asylums may be taught to speak, inasmuch as their dumbness is owing solely to their want of use of the organs of speech. Mutes, says the inventor, will learn to speak by holding the audiphone against the teeth, as already directed, and practice speaking while it is in this position. A good exercise for the mute, at first, to

put one hand on the instructor's throat, watch the motion of his lips, while his other hand is on his own throat, the instructor meantime holding the audiphone to the mute's teeth. The mute will *feel* the influence of the sound in his hand on the instructor's throat, imitate it in his own throat, will *hear* the speaker's voice on the audiphone, and will be aided in imitating the speaker by *seeing* his lips, and will also *hear* his own phonation sounds as reflected from the audiphone, and the more readily therefore learn to articulate.

Music, its varying sounds and harmonies, as conveyed by means of the audiphone, awakens in the semi-deaf-mutes an unusually pleasurable sensation, as manifested by their gesticulations and facial expression.

Under the pretext of being a fan the instrument can seldom be used, and, being cumbersome and conspicuous, is open to the same objections as the ear-trumpet.

Since the advent of the audiphone, we have seen several markedly successful cases of its application, but, as a rule, we think the instrument has been overestimated, and Mr. Joshua Foster, the able Superintendent of the "Pennsylvania Asylum for the Deaf and Dumb," we are sorry to say, was not favorably impressed with the audiphone, although we have heard through other sources of the satisfactory trial of the instrument.

The appliance is, however, in its infancy, and will no doubt be modified to meet many objections and requirements, but in so far as Mr. Rhodes has exerted his ability and ingenuity, we certainly think he is entitled to great praise, not only for his novel invention, but for its novel application.

The opera or concert audiphone is said to possess double power, but as the majority of those who can successfully wield the single disk instrument can use the latter for conversation or concert alike, we do not attach much importance to the double disk instrument. This latter consists of two disks, each about the size of the conversational, fitted into the same base, about a quarter of an inch apart, and separated at the upper edges the same distance, suf

ficiently to be evenly adjusted to different teeth, so that each disk may act independently of the other. The upper edge of each disk is set against *different teeth*, thus giving the vibration of a whole disk to each tooth, and thereby almost doubling the power. This form of audiphone is particularly well adapted for semi-mutes, not only because the sound received is of greater volume and more distinct, but also the voice of the semi-mute when spoken between the disks is very considerably intensified, and therefore the more distinctly heard by himself.

"THE DENTAPHONE"

is a novel instrument of the same practical application and acoustic principle as the audiphone, but constructed more after the plan of the telephone. It is made by the American Dentaphone Co., of Cincinnati, and is a more ingenious and well made appliance.

It is represented at Fig. 2, and consists, in brief, of a chambered box (similar to a telephonic mouth-piece) in which is secured an exceedingly delicate, easily vibrating, diaphragm. Connecting this with a wooden tooth-piece is a silken cord of variable length. The person using the dentaphone simply holds the instrument receiver in his hand in any convenient position, with the tooth-piece between the teeth, and the open side of the receiver facing toward the speaker. The silk conducting line connecting the receiver with the tooth-piece should be kept moderately tight, and may be shortened or lengthened to suit the convenience of the person using the instrument.

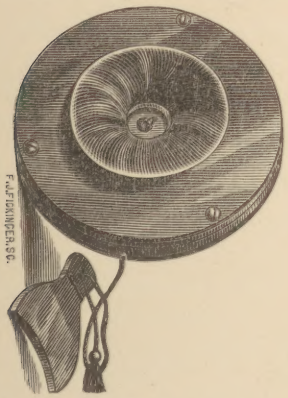

FIG. 2.

The dentaphone weighs but one ounce and a half, and can easily be carried about the person. In testing the instrument, it compares most favorably with the audiphone, and answers fully as well for all requirements.

It is used for precisely the same class of cases as are improved by the audiphone, and bids fair to be a powerful rival.

Concerning an appropriate or descriptive name we would prefer the term "Dento-Audiphone," and recommend the substitution of fans (made of thin elastic wood, "bristol" or "binder's board") which are to be held between or against the teeth, and bent into a curve by pressure from the handle towards the teeth.